PUROLITE®
ION EXCHANGE RESINS

S-930
Macroporous Iminodiacetic Chelating Resin
(For the selective removal of heavy metals from aqueous solutions)

Technical Data

Section IV.   **PRODUCT DESCRIPTION**

Purolite S-930 is a macroporous polystyrene based chelating resin, with iminodiacetic groups designed for the removal of cations of heavy metals from industrial effluents. These cations may be separated from high concentrations of univalent cations (typically sodium) and also from common divalent cations (such as calcium). Removal can be achieved both from weakly acidic and weakly basic solutions depending on the metals to be removed.

Purolite S-930 finds use in processes for extraction and recovery of metals from ores, galvanic plating solutions, pickling baths, and effluents even in the presence of alkaline earth metals (calcium and magnesium).
Further important uses include the refining of the salt solutions of transition and precious metals and for the cleaning and purification of various organic or inorganic chemical products by removal of heavy metals contamination (usually from aqueous solution).

Typical Chemical & Physical Characteristics

Polymer Matrix Structure .... Macroporous Styrene-divinylbenzene
Physical form & Appearance .... Opaque Beige Spheres
Whole Bead Count .... >90%
Functional Groups .... Iminodiacetic
Ionic Form (as shipped) .... Na^+
Shipping Weight .... 710 - 745 g/l (44.5 - 46.5 lb/ft^3)
Screen Size range (British Standard Screen) .... 14-52 mesh, wet
Particle Size range .... + 1.0mm <10%, -0.3mm <1%
Moisture Retention, H^+ Form 55-65%
Reversible Swelling, (H^+ ➤ Na^+) .... <20%
Specific Gravity. Moist H^+ Form 1.17
Total Exchange Capacity, H^+ Form (wet, volumetric) .... 1.1 eq./l., min.
$\quad\quad\quad$ H^+ Form .... 35g of Cu^{++}/l., 2.2 lb/ft^3 min.
$\quad\quad\quad$ Na^+ Form .... 0.94 eq./l., min.
$\quad\quad\quad$ Na^+ Form .... 30g of Cu^{++}/l., 1.9 lb/ft^3 min.
Max, Operating Temperature, H^+ Form .... 70°C (158°F)
pH Range (operating) H^+ Form 2-6
$\quad\quad\quad$ Na^+ Form 6-11

STANDARD OPERATING CONDITIONS

Purolite S-930 :- These operating conditions are given as a general example. However regeneration conditions and flow rates should be chosen for the particular application. For further recommendations please contact your local sales office

Operation	Rate	Solution	Minutes	Amount
Service	8 - 16BV/h 1-2gpm/ft³	For treatment		
Backwash	5-7m/h 2-3gpm/ft²	Raw Water	5-20	1.5-6 BV 10-35 gal/ft³
Regeneration	3-4BV/h 0.4-0.5gpm/ft³	Mineral Acids (2N-3N)	30-60	140-200g/l HCL or 12.5-20lb/ft³ 200-320g/l H_2SO_4
Slow rinse	3-4BV/h 0.4-0.5gpm/ft³	Raw Water	30-40	2-3 BV 15-25gal/ft³
Conversion to sodium form as required:-	3-4BV/h 0.4-0.5gpm/ft³	$^1/_2$N NaOH (Upflow)*	40-60	40-60g/l 2.5-3.75lb/ft³
Rinse	3-4BV/h 0.4-0.5gpm/ft³	Soft or Demin Water	20-40	2-4 BV 15-30gal/ft³

Backwash expansion 75% (optimum)
Design rising space 100%
Minimum bed depth 1000m
"gallons refer to U.S. gallons = 3.785 Litres.

*The aim is to achieve the same pH as that of the incoming solution.

PRINCIPLE OF REACTION

The iminodiacetic functional groups, in either the sodium or the hydrogen form, will chelate heavy metals by ion attraction to the dicarboxylic functionality and electron donation from the nitrogen:
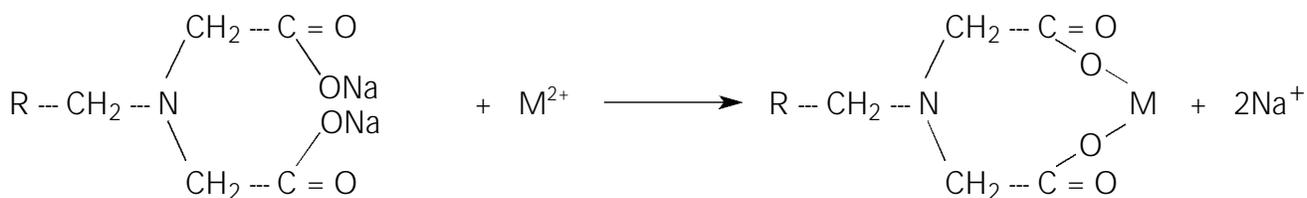
APPLICATIONS

Purolite S -930 is particularly suitable for the removal of heavy metals (as weakly acidic chelated complexes) which are held according to the following order of selectivity.

Cu≫Ni>Zn Co Cd>Fe(II)>Mn>Ca
The macroporous resin structure ensures excellent diffusion of ions thus affording

efficient exhaustion and regeneration.

Recovery of heavy metals from effluents from the plating industry is achieved by concentration and is particularly useful where full demineralisation and recycling of the rinse water is not practised. The simplest case is where only one heavy metal is present, when volumes of rinse water are low, waste water fees may be low, and raw water has a low salt content.

Purolite S-930 can be used to reduce residual toxic heavy metals to below the maximum admissible concentration levels which are often far below those obtainable after precipitation reactions. It may also be used to remove similar residuals from demineralised rinse water circuits.

Purolite S -930 is also used to separate and concentrate heavy metals in hydro-metallurgical processes (ore dressing and scrap recovery). It is particularly suitable where metals are present in low concentrations. Separation techniques may be carried out according to the order of selectivity given above. However changes in the sequence occur with change in pH and in the presence of certain anions (including higher concentrations of chloride and sulphate). The sequence given above is applicable for neutral and weakly acidic solutions.

OPERATING PERFORMANCE

The information below may be taken as a general guide. However, before any plant design is contemplated, the user should ascertain the exact operating performance under the proposed conditions of use, by way of column testing of the feed solution to be treated.

The operating capacity is a function of pH,
and inlet concentration solution for each metal. Fig. 1 gives the exchange capacity obtainable when using the operating conditions given above, as a function of pH. This capacity is a function of ionic concentration, hence the multiplication factor given in fig. 2 should be applied.
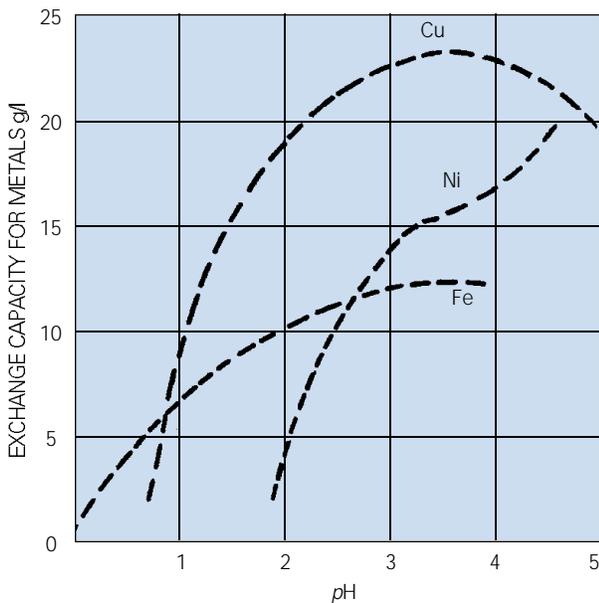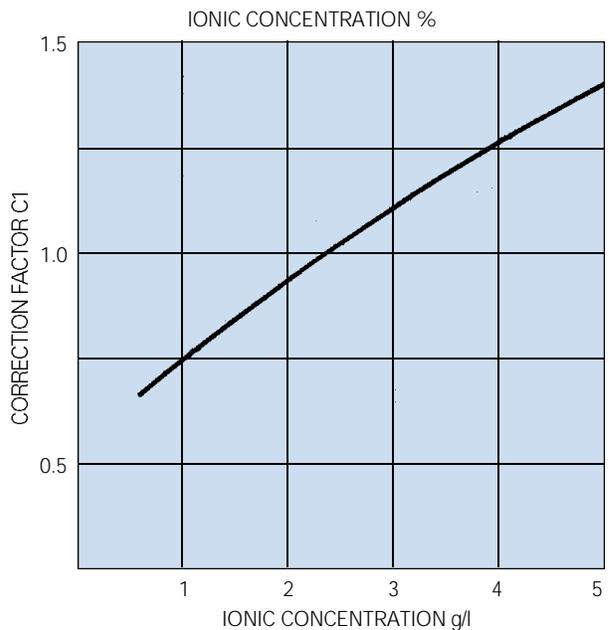
Fig. 1. Exchange capacity for metals as a function of pH.

Fig. 2. Correction factor for ionic concentration

HYDRAULIC CHARACTERISTICS (General Applications)

The pressure drop (or headloss) across a properly classified bed of ion-exchange resin depends on the particle size distribution, bed depth, and voids volume of the exchange material, and on the flow rate and viscosity (and hence on the
temperature) of the influent solution. Anything affecting any of these parameters, for example the presence of particulate matter filtered out by the bed, abnormal compaction of the resin bed, or the incomplete classification of the bed will

have an adverse effect, and result in an increased headloss. Service flow rates from 8-16 bed volumes per hour, 1-2gpm/ft^3, depending on the application, may be regarded as the normal range used on this resin.

Typical pressure drop figures to be expected for ordinary aqueous solutions, are given in fig. 3., below. This is applicable to the freshly regenerated H$^+$ Form. As the resin is converted to the metal form the pressure drop will decrease slightly.

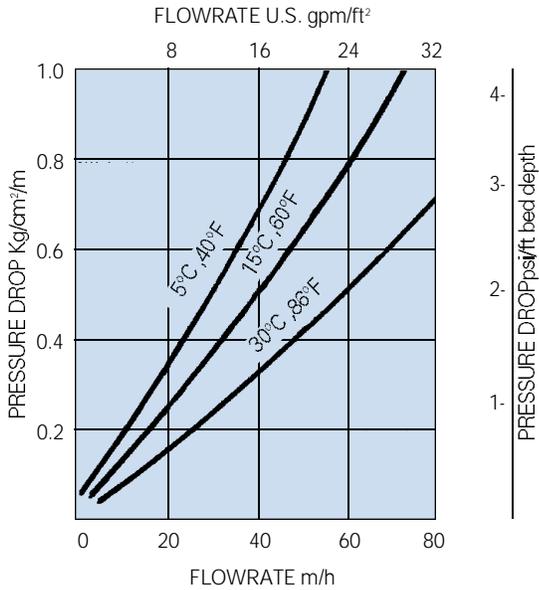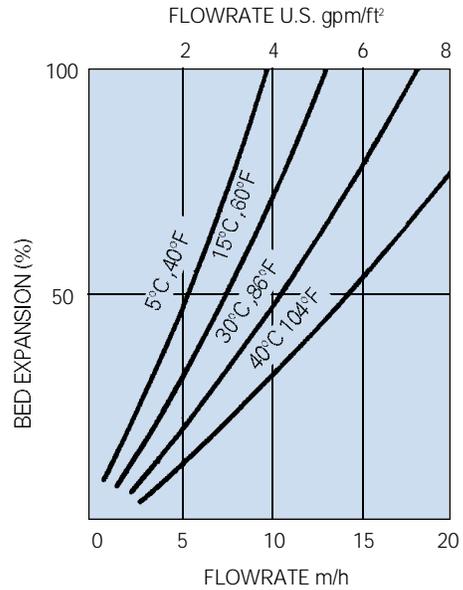Fig. 3 PRESSURE DROP VS. FLOWRATE

Fig. 4 BACKWASH EXPANSION
(Exhausted Form)

During upflow backwash, the resin bed should be expanded in volume by between 50 and 75%, in order to free it from any particulate matter from the influent solution, to clear the bed of bubbles and voids, and to reclassify the resin particles as much as possible, ensuring minimum resistance to flow. Bed expansion increases with flow rate and decreases with temperature, as shown in fig. 4, for a typical exhausted form of the resin. Care should always be taken to avoid resin loss by over-expansion of the bed.

CONVERSION OF UNITS

1 m/h (cubic metres per square metre per hour)	= 0.341 gpm./ft^2.
	= 0.409 U.S. gpm./ft^2.
1Kg/cm^2 /m (Kilograms per square cm. per metre of bed)	= 4.33 psi/ft.
	= 1.03 atm./m/
	= 10 ft. H$_2$O/ft